

1. A transducer comprising:

a fixed plate;

a first capacitive sensor array on the surface of said fixed plate, said first capacitive sensor array having a periodic pattern of conductive elements;

a suspension plate with a proof mass supported by a plurality of flexural elements engaging a frame; said plurality of flexural elements capable of constraining said proof mass to motion in a single axis;

a second capacitive sensor array on a surface of said proof mass, said second capacitive sensor array comprising a periodic pattern of equal periodicity to said first capacitive sensor array, with the direction of the periodicity parallel to said constrained motion of said proof mass;

said fixed plate mounted to said frame of said suspension plate to allow said first capacitive sensor array to be aligned in a common direction of periodicity in separated opposition;

an electrical connection to said first capacitive sensor array on said fixed plate allowing a coupling of cyclic excitations from external electronics through said periodic pattern of said first capacitive sensor array to said periodic pattern of said second capacitive sensor array, said coupling ranging between zero and one hundred percent and being a cycling positional measure of said proof mass with respect to said fixed plate in said constrained planar direction;

an electrical connection to said proof mass sensor array transmitting a signal resulting from said coupling of said fixed plate sensor array to said proof mass sensor array to external electronics for determination of percentage of said coupling and transduce the position of said proof mass.

2. An accelerometer comprising:

a transducer for determining the position of a proof mass relative to a fixed plate by determining a coupling capacitance between a first capacitive sensor array on a surface of said fixed plate and a second capacitive sensor array on the surface of said proof mass,

an actuator for generating and emitting an actuation signal in order to move said proof mass;

feedback electronics for using said proof mass position as determined by said transducer in order to produce a feedback signal in order to control said actuator, thereby managing the actuation signal and controlling the motion of said proof mass within desired parameters; and

a means for measuring the actuation signal and determining an acceleration component of the movement of the proof mass as a function thereof.

3. The accelerometer of claim 23, wherein the feedback signal controls the actuator in order to maintain said proof mass in approximately a null position within one cycle of said transducer.

4. The accelerometer of claim 23, further comprising:

a velocity sensor having a means for determining a velocity component for the movement of said proof mass by measuring the voltage within said feedback electronics and calculating the velocity component as a function of such measurement.

5. The accelerometer of claim 23, further comprising:

limit control electronics for receiving said actuation signal generated by the actuator and temporarily zeroing said actuation signal if said actuation signal exceeds a preset limit corresponding to movement of said proof mass of a distance substantially more than one half a repeat distance of said transducer.

6. The accelerometer of claim 23, wherein the proof mass is supported by a plurality of flexural elements, said flexural elements constraining movement of said proof mass to a single direction or axis.

7. The accelerometer of claim 27 wherein the flexural elements allow in plane movement in two directions, said in plane movement detected by a second set of separate sensor arrays aligned in periodicity to said two directions.
8. The accelerometer of claim 23, wherein the actuator is an electrostatic actuator.
9. The accelerometer of claim 29, wherein the electrostatic actuator includes a set of actuator plates, one positioned on the fixed plate and one on the proof mass; said plates arranged to receive the actuating signal and generate a force sufficient to move the proof mass.
10. The accelerometer of claim 30, wherein the force generated as a linear function of said actuating signal.
11. The accelerometer of claim 23, wherein the actuator is an electromagnetic actuator.

12. The accelerometer of claim 32 wherein the electromagnetic actuator includes:

a fixed external magnetic circuit having two magnet sets on each side of the proof mass;

main feedback coil and an integrator feedback coil on said proof mass;

external feedback circuitry using said proof mass position determined from said transducer, said feedback circuitry providing separate feedback currents to said main feedback coil and said integrator feedback coil in order to stimulate electro-magnetic interactions between the two coils and magnets, thereby controlling the movement and position of the proof mass, said main feedback coil and said integrator feedback coil nulling velocity input signals and position input signals to said transducer; and

limit control electronics for temporarily zeroing said feedback current provided to said integrator feedback coil when said current exceeds a preset limit corresponding to movement by the proof mass, in either direction, of a distance greater than one half of a repeat distance of said transducer.

13. The accelerometer of claim 33 wherein said proof mass is comprised of two wafers bonded together and said integrator feedback coil is located centrally between said two wafers to provide symmetric actuation.

14. The accelerometer of claim 33 with said external feedback circuitry driving said main feedback coil and said integrator feedback coil in a transconductance configuration.

15. The accelerometer of Claim 29 having an additional electrostatic actuator to provide a calibration input.

16. The accelerometer of Claim 32 having an additional electromagnetic actuator to provide a calibration input.